

Space Weather Technical Forecast

Issued on Friday, 10 December 2021 at 00:38 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance of G1/Minor Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low over the past 24 hours with no notable flares. There are no sunspots currently on the visible disc. No Earth-directed CMEs have been observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, has remained at background levels, with the density at predominantly average levels. The IMF, Bt, was weak below 3 nT, and the north-south component (Bz) varied between +2/-2 nT. The phi angle was predominately positive (away from the Sun). Resultant geomagnetic activity during the period was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. The high energy electron flux (greater than 2 MeV) started and ended the day at background levels, but did increase through the diurnal cycle to breach the 1000pfu High threshold. The flux peaked at 1281 pfu at 09/1740UTC. The associated 24-hour integrated fluence has been below the Active threshold throughout (1e8 integrated pfu), although with a very slightly increasing trend, with 5.64e7 integrated pfu observed at 10/0000 UTC.

Four-Day Space Weather Forecast Summary

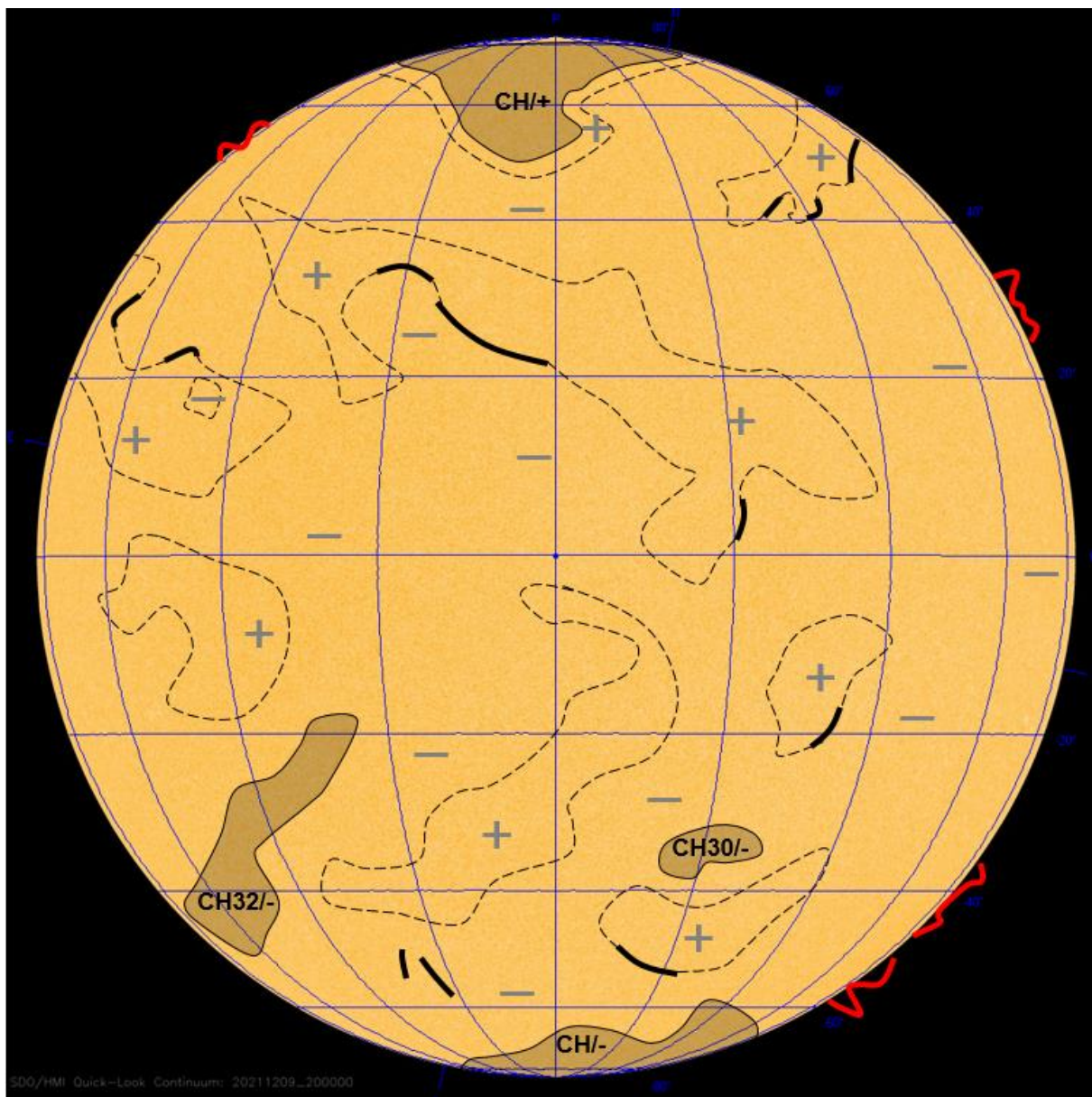
Solar Activity: Solar activity is expected to stay predominantly Very Low during the forecast period, with the current absence of any regions on the visible disc. However, towards the end of the period new regions may rotate onto the visible disc and potentially increase the activity.

Solar Wind / Geomagnetic Activity: There are two potentially Earth-directed CMEs in the forecast. The first CME was due to arrive yesterday evening, although with low confidence, and it may still arrive early today. The second CME could arrive at Earth as a weak feature today. After starting at background levels, minor fast wind enhancements are possible for the solar wind today from the aforementioned CMEs. Another enhancement of the solar wind up to slightly elevated levels is more likely tomorrow and day 3 (11th and 12th) due to the expected arrival of a weak high speed stream from CH30, this persisting through day 4 (13th). Mainly Quiet to Unsettled (Kp 0-3) geomagnetic activity is expected through the period, with a chance of isolated Active periods (Kp 4) and a slight chance of G1/Minor Storms (Kp 5).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is likely to be mainly at Moderate or background levels, but perhaps increasing to High on Day 3 or 4 (11th or 12th). The associated 24-hour integrated fluence is expected to persist below the Active threshold.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

Figure 1. Solar Analysis Valid 09/2000 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are two potentially Earth-directed CMEs in the forecast. The first CME was expected to arrive yesterday around 1800UTC, however confidence was low with a +/-9 hour range of arrival time. Therefore it is possible the weak CME may still arrive early today. The second CME could arrive at Earth as a weak feature today (10th) around 0900 UTC, but with low confidence and a +/-12hrs range of arrival time. Although initially solar winds will be at background levels, minor fast wind enhancements are possible today from the aforementioned CMEs. Another enhancement of the solar wind up to slightly elevated levels is more likely from late tomorrow or early day 3 (11th and 12th) due to the expected arrival of weak coronal hole influence, this persisting through day 4 (13th). Mainly Quiet to Unsettled geomagnetic activity is expected through the period, with a chance of isolated Active periods and a slight chance of Minor Storms.

No significant enhancement has been observed at STEREO-A at the time of writing, which is currently ~2.8 days ahead of Earth, but STEREO A is positioned further north than Earth with respect to CH30, so may not connect with this feature.

Mainly Quiet to Unsettled (Kp 0-3) geomagnetic activity is expected through the period, with a chance of isolated Active (Kp 4) periods and a slight chance of G1/Minor Storms (Kp 5).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	10	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
05/2337	Partial halo	Filament eruption	South centre disk	325 km/s	09/1800UTC	Limited shock expected
06/1613	Partial halo	Filament eruption	SE quadrant	310 km/s	10/0900UTC	Limited shock expected

Figure 2: Latest SDO AIA 193 image showing CH30, which has reduced in size and so potential influence over the past 24 hours.



Radio Blackouts - X-Ray Flares:

Solar Activity has been at Very Low levels during the past 24 hours. There are currently no sunspot regions on the visible disc. However, towards the end of the period new regions may rotate onto the visible disc and potentially increase the activity. Solar activity is expected to remain Very Low throughout the forecast period in the absence of any sunspot development.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is forecast to remain at background levels.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as observed by GOES-16 is currently at Moderate levels, but did rise through the diurnal cycle to reach high levels (1000pfu) yesterday. The same is likely to occur today if the two forecast CME's do not arrive. A slight increase in high energy electron values may occur during Days 3 and 4 (12th and 13th), with any CME associated geomagnetic activity subsiding, given the anticipated arrival of CH30.

Fluence levels are expected to remain below the Active threshold throughout the forecast period, but with a gradually increasing trend. This anticipated trend is in contrast to the guidance offered by the Met Office REFM model, which is starting today with observed values higher than the model predicts. Therefore confidence is low with the REFM prediction.

GEO Electron Environment	Level (cm ⁻² sr ⁻¹ day ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1x10 ⁸	No	10	10	20	20
Very Active	≥ 2 MeV ≥ 1x10 ⁹	No	1	1	1	1

Figure 3: The Met Office REFM Model.

